

Supplement

Tables

Table S1. The standard emission rates of isoprene (ER) and specific leaf area (SLA) for species used in this study. Emission Factor (EF) is: $EF = ER/SLA$.

Species	ER ($\mu\text{g C g}^{-1} \text{ h}^{-1}$)	SLA ($\text{cm}^2 \text{ g}^{-1}$)	EF ($\mu\text{g C m}^{-2} \text{ h}^{-1}$)
	<i>Broadleaf</i>	<i>Evergreen</i>	<i>Trees</i>
<i>Acacia confusa</i>	0.8 ^[1]	100 ^[2]	80
<i>Albizia chinensis</i>	0.1 ^{[3][4]}	100 ^[2]	10
<i>Areca catechu</i>	70 ^[5]	100 ^[2]	7000
<i>Bambusa</i>	32.3 ^{[3][6]}	277 ^[7]	1166.1
<i>Bombax ceiba</i>	0.1 ^[1]	211.6 ^[8]	4.7
<i>Castanea seguinii</i>	0 ^[9]	/	0
<i>Castanopsis</i>	1.4 ^[10]	51.6 ^{[7][11]}	271.3
<i>Cercis chinensis</i>	7.2 ^[10]	100 ^[2]	720
<i>Choerospondias axillaris</i>	0.1 ^[1]	205 ^[12]	4.9
<i>Chukrasia tabularis</i>	0.1 ^[1]	100 ^[2]	10
<i>Cinnamomum camphora</i>	0.2 ^{[3][6]}	100 ^[2]	20
<i>Cocos nucifera</i>	63.1 ^[13]	100 ^[2]	6310
<i>Cryptocarya chinensis</i>	95.9 ^[1]	100 ^[2]	9590
<i>Cyclobalanopsis</i>	278.9 ^[3]	100 ^[2]	27890
<i>Dendrocalamus</i>	70 ^[1]	100 ^[2]	7000
<i>Dipterocarpus</i>	0.1 ^[1]	100 ^[2]	10
<i>Dysoxylum</i>	0.1 ^[1]	100 ^[2]	10
<i>Elaeocarpus decipiens</i>	11.9 ^[14]	100 ^[2]	1190
<i>Eucalyptus</i>	60 ^[15]	100 ^[2]	6000
<i>Fargesia</i>	4.3 ^[10]	100 ^[2]	430
<i>Ficus benjamina</i>	9.4 ^[3]	120.1 ^[8]	782.7
<i>Ficus microcarpa</i>	1.4 ^[1]	120.1 ^[8]	116.6
<i>Ficus (other)</i>	70 ^[1]	120.1 ^[8]	5828.5

<i>Garcinia paucinervis</i>	0.1 ^[1]	100 ^[2]	10
<i>Hevea brasiliensis</i>	2.6 ^[3]	100 ^[2]	260
<i>Indocalamus tessellatus</i>	4.3 ^[10]	100 ^[2]	430
<i>Lithocarpus</i>	1.5 ^[16]	97 ^[12]	154.6
<i>Madhuca pasquieri</i>	69.5 ^[17]	100 ^[2]	6950
<i>Michelia figo</i>	0.1 ^[3]	100 ^[2]	10
<i>Neosinocalamus affinis</i>	35.2 ^[18]	48.3 ^[19]	7287.8
<i>Phellodendron amurens</i>	0.1 ^[1]	100 ^[2]	10
<i>Phyllostachys edulis</i>	102.2 ^{[10][20]}	250 ^[7]	4088
<i>Phyllostachys (other)</i>	70 ^{[1][15][21]}	250 ^[7]	2800
<i>Pleiblastus amarus</i>	75.8 ^[10]	179.2 ^[22]	4229.9
<i>Podocarpus imbricatus</i>	0 ^[1]	/	0
<i>Pometia pinnata</i>	2.5 ^[3]	100 ^[2]	250
<i>Pseudosasa</i>	32.3 ^[3]	100 ^[2]	3230
<i>Qiongzhusa tumidinoda</i>	32.3 ^[3]	100 ^[2]	3230
<i>Schima argentea</i>	0.1 ^[1]	112 ^[7]	8.9
<i>Schima wallichii</i>	0 ^[1]	/	0
<i>Sterculia lanceolata</i>	0.1 ^[1]	100 ^[2]	10
<i>Terminalia</i>	0 ^[3]	/	0
<i>Yushania</i>	32.3 ^[3]	20 ^[19]	16150
<i>Others</i>	1.5 ^[16]	100 ^[2]	150
<i>Broadleaf Deciduous Trees</i>			
<i>Acer pictum subsp. mono</i>	0 ^[1]	/	0
<i>Acer (other)</i>	0.1 ^[1]	230.7 ^[23]	4.3
<i>Alnus nepalensis</i>	0.1 ^[1]	100 ^[2]	10
<i>Amygdalus persica</i>	10.6 ^[24]	100 ^[2]	1060
<i>Armeniaca</i>	7.0 ^[24]	100 ^[2]	700
<i>Betula ermanii</i>	0 ^[1]	/	0
<i>Betula platyphylla</i>	0.1 ^[1]	198 ^[25]	5.1
<i>Betula luminifera</i>	0.1 ^[1]	145.4 ^[7]	6.9

<i>Betula utilis</i>	0.1 ^[1]	217.1 ^[23]	4.6
<i>Betula (other)</i>	0.1 ^{[1][13]}	113 ^[9]	8.8
<i>Dalbergia hupeana</i>	30.1 ^[10]	100 ^[2]	3010
<i>Diospyros kaki</i>	0.2 ^[24]	100 ^[2]	20
<i>Fagus</i>	0.1 ^[15]	83 ^[12]	12
<i>Fraxinus</i>	0.1 ^[1]	95.7 ^[26]	10.4
<i>Ginkgo biloba</i>	0 ^{[3][6]}	/	0
<i>Juglans mandshurica</i>	0 ^[1]	/	0
<i>Juglans regia</i>	3.1 ^[24]	100 ^[2]	310
<i>Liquidambar formosana</i>	65.5 ^[10]	162 ^[12]	4043.2
<i>Malus sieversii</i>	0.9 ^{[3][6]}	152 ^[9]	59.2
<i>Morus alba</i>	0.1 ^[1]	100 ^[2]	10
<i>Phellodendron</i>	0.1 ^[1]	100 ^[2]	10
<i>Populus simonii</i>	191.1 ^[27]	100 ^[2]	19110
<i>Populus suaveolens</i>	40 ^{[1][28]}	100 ^[2]	4000
<i>Populus (other)</i>	105.8 ^[6]	158.6 ^{[7][29]}	6671
<i>Pyrus</i>	0.3 ^[24]	100 ^[2]	30
<i>Quercus liaotungensis</i>	98.9 ^[1]	100 ^[2]	9890
<i>Quercus aliena</i>	65.5 ^[9]	106.9 ^[9]	6127.2
<i>Quercus dentata</i>	32.1 ^[9]	106.9 ^[9]	3002.8
<i>Quercus variabilis</i>	65.5 ^{[9][29]}	99.2 ^[29]	6602.8
<i>Quercus glandulifera</i>	196 ^[10]	159 ^[7]	12327
<i>Quercus (other)</i>	70 ^{[1][15]}	100 ^[2]	7000
<i>Robinia</i>	49.8 ^[29]	100 ^[2]	4980
<i>Salix</i>	70.2 ^[3]	150.6 ^[29]	4661.4
<i>Sassafras tzum</i>	0.1 ^[28]	100 ^[2]	10
<i>Tilia</i>	0.1 ^[1]	64.2 ^[26]	15.6
<i>Ulmus</i>	0.3 ^{[3][6]}	142.7 ^[29]	21
<i>Others</i>	1.5 ^[16]	100 ^[2]	150
<i>Needleleaf</i> <i>Evergreen</i> <i>Trees</i>			

<i>Abies</i>	0.1 ^[1]	28.3 ^[7]	35.3
<i>Casuarina equisetifolia</i>	2.9 ^[3]	150 ^[2]	193.3
<i>Cryptomeria fortunei</i>	0.6 ^[3]	150 ^[2]	40
<i>Cunninghamia lanceolata</i>	0.1 ^[15]	61 ^[7]	16.4
<i>Cupressus funebris</i>	0.1 ^[3]	150 ^[2]	6.7
<i>Juniperus</i>	0.1 ^[1]	150 ^[2]	6.7
<i>Keteleeria fortunei</i>	0.1 ^[28]	150 ^[2]	6.7
<i>Picea jezoensis</i> Carr. var. <i>microsperma</i>	7.2 ^[1]	14 ^[7]	5142.9
<i>Picea</i> (other)	8 ^{[6][12]}	14 ^[6]	5714.3
<i>Pinus armandii</i>	0 ^{[1][13]}	/	0
<i>Pinus bungeana</i>	0 ^[6]	/	0
<i>Pinus koraiensis</i>	0 ^[3]	/	0
<i>Pinus massoniana</i>	0.7 ^{[3][7]}	51.5 ^[7]	135.9
<i>Pinus pumila</i>	0.1 ^[1]	64.1 ^[7]	15.6
<i>Pinus yunnanensis</i>	0 ^{[1][13]}	/	0
<i>Pinus</i> (other)	0.4 ^{[3][6]}	64.1 ^{[7][29]}	62.4
<i>Platycladus orientalis</i>	0 ^[1]	/	0
<i>Sabina przewalskii</i>	0.1 ^[3]	34.7 ^[30]	28.8
<i>Tsuga</i>	0.1 ^[15]	75 ^[31]	13.3
<i>Others</i>	1.5 ^[16]	150 ^[2]	100
<i>Needleleaf Deciduous Trees</i>			
<i>Larix gmelinii</i>	0 ^[3]	/	0
<i>Larix olgensis</i>	0 ^[1]	/	0
<i>Larix principis-rupprechtii</i>	7.4 ^[1]	113 ^[7]	654.9
<i>Larix</i> (other)	0.1 ^[1]	113 ^[7]	8.8
<i>Metasequoia glyptostroboides</i>	0 ^[32]	/	0
<i>Taxodium distichum</i>	0.5 ^[1]	150 ^[2]	33.3
<i>Others</i>	1.5 ^[16]	150 ^[2]	100
<i>Shrubs</i>			

<i>Acacia farnesiana</i>	0.1 ^[1] [4]	112.4 ^[9]	8.9
<i>Alchornea trewioides</i>	0.1 ^[1]	131 ^[33]	7.6
<i>Amygdalus mongolica</i>	10.6 ^[24]	112.4 ^[9]	943.1
<i>Armeniaca sibirica</i>	7 ^[24]	70 ^[9]	1000
<i>Baeckea frutescens</i>	10 ^[34]	112.4 ^[9]	889.7
<i>Bauhinia championii</i>	70 ^[1]	90 ^[35]	7777.8
<i>Bauhinia faberi</i>	70 ^[1]	112.4 ^[9]	6227.8
<i>Berberis</i>	14 ^[1]	112.4 ^[9]	1245.6
<i>Caragana</i>	0.1 ^[1]	10.9 ^[36]	91.7
<i>Castanea</i>	0 ^[9]	/	0
<i>Cipadessa cinerascens</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Corylus heterophylla</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Cotinus coggygria Scop.</i>	0.1 ^[1]	122.3 ^[37]	8.2
<i>Croton argyratus</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Desmos chinensis</i>	0 ^[5]	/	0
<i>Dracaena cambodiana</i>	0.1 ^[1]	318 ^[38]	3.1
<i>Elaeagnus pungens</i>	1.5 ^[16]	152 ^[39]	98.7
<i>Gleditsia microphylla</i>	0.3 ^[40]	112.4 ^[9]	26.7
<i>Hippophae rhamnoides</i>	1.5 ^[16]	43.9 ^[41]	341.7
<i>Juniperus squamata</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Lespedeza</i>	35.6 ^[10]	255.4 ^[42]	1393.9
<i>Liquidambar formosana</i>	65.5 ^[10]	162 ^[12]	4043.2
<i>Litsea populifolia</i>	0.1 ^[1]	180 ^[43]	5.6
<i>Loropetalum chinense</i>	1.5 ^[16]	117 ^[12]	128.2
<i>Macaranga denticulata</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Mallotus barbatus</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Malus baccata</i>	1.5 ^[16]	65.8 ^[9]	228
<i>Ostryopsis davidiana</i>	1.5 ^[16]	117 ^[42]	128.2
<i>Phyllanthus</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Pinus yunnanensis var. pygmaea</i>	0 ^[13]	/	0

<i>Potentilla</i>	1.5 ^[16]	50 ^[44]	300
<i>Psidium guajava</i>	1.5 ^[16]	67.3 ^[31]	222.9
<i>Quercus fabri</i>	40 ^[28]	232 ^[12]	1724.1
<i>Quercus glandulifera</i>	196 ^[10]	159 ^[7]	12327
<i>Quercus</i> (other)	40 ^[28]	112.4 ^[9]	3558.7
<i>Rhododendron przewalskii</i>	0.1 ^[1]	80 ^[35]	12.5
<i>Rhododendron simsii</i>	0.1 ^[1]	112.4 ^[9]	8.9
<i>Rhododendron</i> (other)	0.1 ^[1]	42.5 ^[45]	23.5
<i>Rhus chinensis</i>	0.2 ^{[1][13]}	180 ^[46]	11.1
<i>Rosa</i>	0.1 ^[1]	84.8 ^[41]	11.8
<i>Sabina</i>	0.1 ^[3]	34.7 ^[30]	28.8
<i>Salix</i>	70.2 ^[3]	150.6 ^[2]	4661.4
<i>Sibiraea angustata</i>	1.5 ^[16]	141.9 ^[47]	105.7
<i>Sophora moorcroftiana</i>	1.5 ^[16]	41.8 ^[41]	358.9
<i>Spiraea</i>	0.1 ^[1]	145.8 ^[42]	6.9
<i>Syringa</i>	0.2 ^[6]	173.5 ^[8]	11.5
<i>Tamarix</i>	1.5 ^[16]	22.5 ^[48]	666.7
<i>Vitex negundo</i>	1.5 ^[16]	170 ^[35]	88.2
<i>Others</i>	1.5 ^[16]	112.4 ^[9]	133.5

Table S2. The monthly averaged PFT-ecoregion dependent base LAIs for eight ecoregions in Fig. S2. These base LAI values are used to derive PFT LAIs at each grid cell.

Ecoregion	PFT	May	Jun	Jul	Aug	Sept
<i>Boreal conifer forest</i>	<i>Broadleaf evergreen tree</i>	/ ^[a]	/	/	/	/
	<i>Broadleaf deciduous tree</i>	2.2	5	5	5	2.6
	<i>Needleleaf evergreen tree</i>	2.9	5	5	5	3.0
	<i>Needleleaf deciduous tree</i>	2.7	5	5	5	2.3
	<i>Shrub</i>	1.0	2.6	3.2	2.3	1.0

	<i>Crop</i>	0.7	2.7	4	4	1.3
	<i>Grass</i>	1.0	4	4	4	1.8
<i>Temperate mixed forest</i>	<i>Broadleaf evergreen tree</i>	/	/	/	/	/
	<i>Broadleaf deciduous tree</i>	2.4	5	5	5	5
	<i>Needleleaf evergreen tree</i>	2.8	5	5	5	4.1
	<i>Needleleaf deciduous tree</i>	2.4	5	5	5	2.6
	<i>Shrub</i>	2.1	4	4	4	2.5
	<i>Crop</i>	0.5	1.4	4	4	2.1
	<i>Grass</i>	0.9	2.0	3.6	3.8	2.0
<i>Temperate deciduous forest</i>	<i>Broadleaf evergreen tree</i>	2.6	3.2	4.8	7	6.3
	<i>Broadleaf deciduous tree</i>	5	5	5	5	5
	<i>Needleleaf evergreen tree</i>	4.3	5	5	5	5
	<i>Needleleaf deciduous tree</i>	3.5	5	5	5	4.7
	<i>Shrub</i>	4	4	4	4	4
	<i>Crop</i>	1.4	2.0	3.1	4	2.0
	<i>Grass</i>	1.5	3.1	4	4	2.6
<i>Subtropical evergreen forest</i>	<i>Broadleaf evergreen tree</i>	7	7	7	7	7
	<i>Broadleaf deciduous tree</i>	5	5	5	5	5
	<i>Needleleaf evergreen tree</i>	5	5	5	5	5
	<i>Needleleaf deciduous tree</i>	5	5	5	5	5
	<i>Shrub</i>	2.0	3.0	3.3	4	3.2

	<i>Crop</i>	1.6	1.8	3.5	4	2.5
	<i>Grass</i>	1.3	2.2	3.1	3.3	2.4
<i>Tropical monsoon forest</i>	<i>Broadleaf evergreen tree</i>	7	7	7	7	7
	<i>Broadleaf deciduous tree</i>	5	5	5	5	5
	<i>Needleleaf evergreen tree</i>	3.4	5	5	5	5
	<i>Needleleaf deciduous tree</i>	/	/	/	/	/
	<i>Shrub</i>	4	4	4	4	4
	<i>Crop</i>	2.0	2.4	2.7	3.2	3.3
	<i>Grass</i>	1.5	2.2	2.1	3.0	2.4
<i>Steppes</i>	<i>Broadleaf evergreen tree</i>	/	/	/	/	/
	<i>Broadleaf deciduous tree</i>	2.0	5	5	5	2.9
	<i>Needleleaf evergreen tree</i>	2.3	4.7	5	5	3.1
	<i>Needleleaf deciduous tree</i>	2.0	5	5	5	2.1
	<i>Shrub</i>	0.8	1.1	1.8	1.4	0.8
	<i>Crop</i>	0.6	1.6	4	4	1.8
	<i>Grass</i>	0.6	1.4	2.4	2.4	1.3
<i>Desert</i>	<i>Broadleaf evergreen tree</i>	7	7	7	7	5.9
	<i>Broadleaf deciduous tree</i>	5	5	5	5	3.7
	<i>Needleleaf evergreen tree</i>	3.7	4.9	5	4.5	3.0
	<i>Needleleaf deciduous tree</i>	4.1	5	5	4.9	2.8
	<i>Shrub</i>	0.6	0.6	0.6	0.7	0.6

	<i>Crop</i>	1.0	2.1	3.5	3.0	1.6
	<i>Grass</i>	0.8	1.3	1.7	1.5	0.9
<i>High-mountain vegetation</i>	<i>Broadleaf evergreen tree</i>	3.2	7	5.6	7	6.7
	<i>Broadleaf deciduous tree</i>	2.7	5	5	5	5
	<i>Needleleaf evergreen tree</i>	2.4	4.9	4.0	5	4.3
	<i>Needleleaf deciduous tree</i>	1.3	2.5	5	5	2.0
	<i>Shrub</i>	0.4	0.5	0.6	0.6	0.5
	<i>Crop</i>	1.2	2.7	4	3.5	1.8
	<i>Grass</i>	0.6	1.4	2.0	2.4	1.3

[a]: The PFT is not present in the ecoregion.

Figures

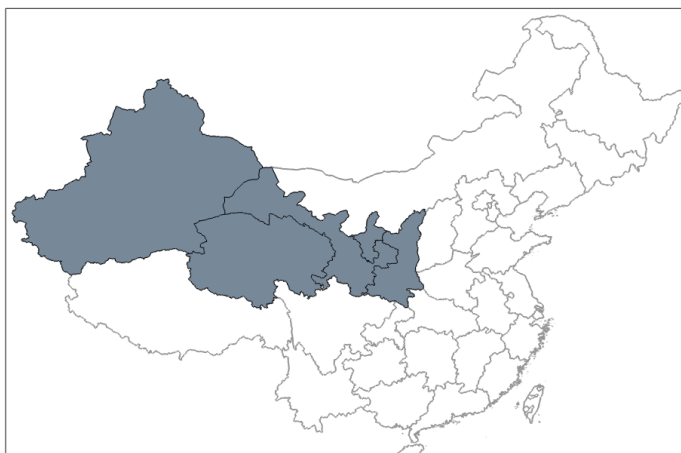


Figure S1. Region (shaded) in which the emission factor (EF) and temperature dependence were adjusted for grass. As discussed in Section 2.1 and 2.2.1.

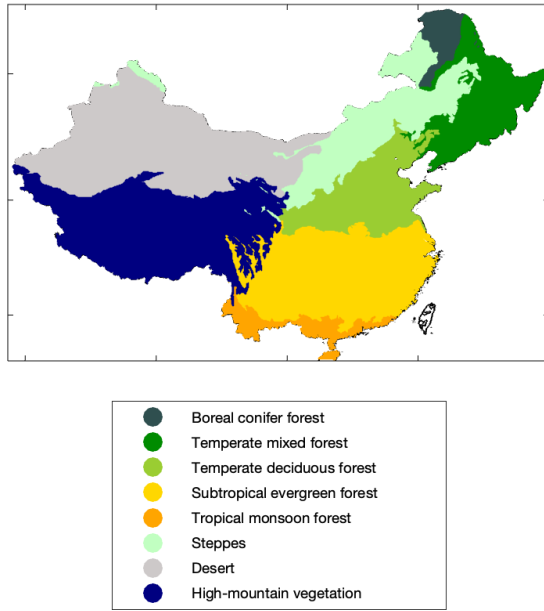


Figure S2. Ecoregion map used to assign region-specific PFT LAIs. Mainland China is divided into eight ecoregions: Boreal conifer forest, Temperate mixed forest, Temperate deciduous forest, Subtropical evergreen forest, Tropical monsoon forest, Steppes, Desert, High-mountain vegetation, following Rodríguez and Pérez (2013) and the Vegetation Atlas of China (Zhang, 2007).

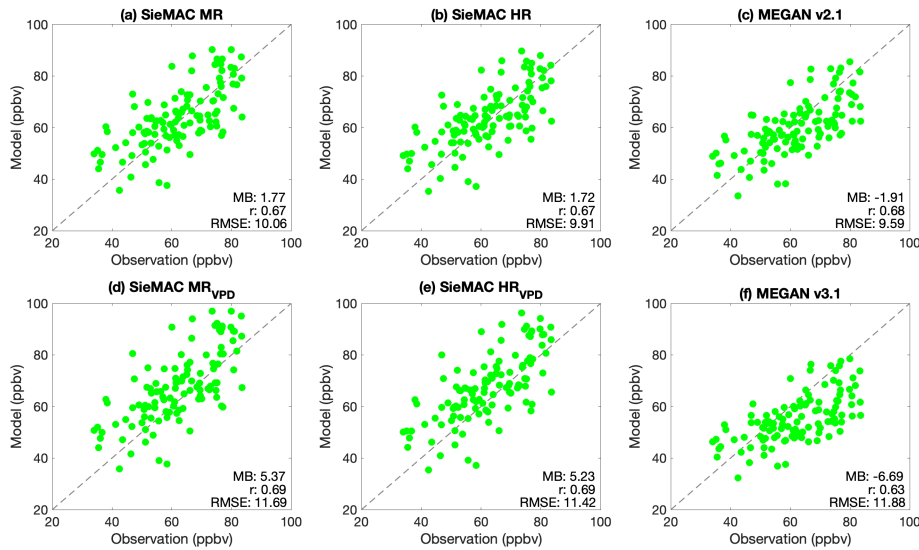


Figure S3. Evaluation of the REAM simulations for surface Ozone (O_3) during summer 2013. Scatterplots compare modeled site mean maximum daily 8-h average ozone (MDA8) with observations from the China National Environmental Monitoring Centre (CNEMC) network for six emission configurations: (a) SieMAC MR, (b) SieMAC HR, (c) MEGAN v2.1, (d) SieMAC MR_{VPD}, (e) SieMAC HR_{VPD}, and (f) MEGAN v3.1. Each point represents one monitoring site; the dashed line marks the 1:1 relation. Panel annotations list the mean bias (MB), root-mean-square error (RMSE), and Pearson correlation coefficient (r) for each configuration.

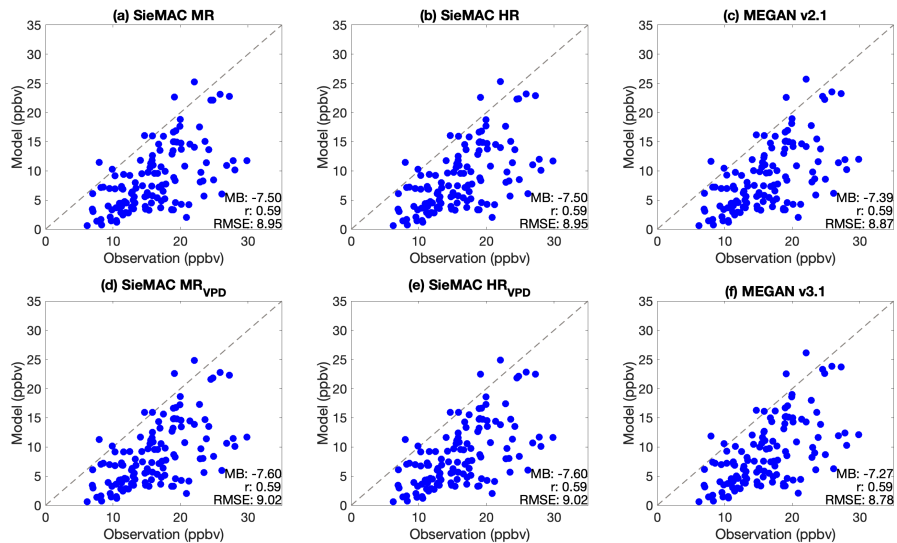


Figure S4. Evaluation of the REAM simulations for surface nitrogen dioxide (NO_2) during summer 2013. Scatterplots compare seasonal mean model values with observations from the China National Environmental Monitoring Centre (CNEMC) network at individual sites for six emission configurations: (a) SieMAC MR, (b) SieMAC HR, (c) MEGAN v2.1, (d) SieMAC MR_{VPD}, (e) SieMAC HR_{VPD}, and (f) MEGAN v3.1. The dashed line denotes the 1:1 relation, and panel annotations give the mean bias (MB), root-mean-square error (RMSE), and Pearson correlation coefficient (r) for each configuration.

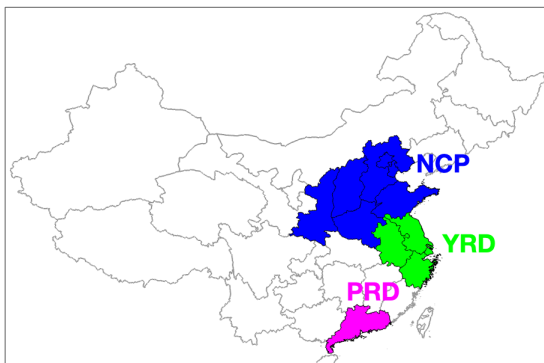


Figure S5. Administrative-map outline showing the three study regions analysed in Section 4.2.2: North China Plain (NCP, blue), Yangtze River Delta (YRD, green), and Pearl River Delta (PRD, magenta)

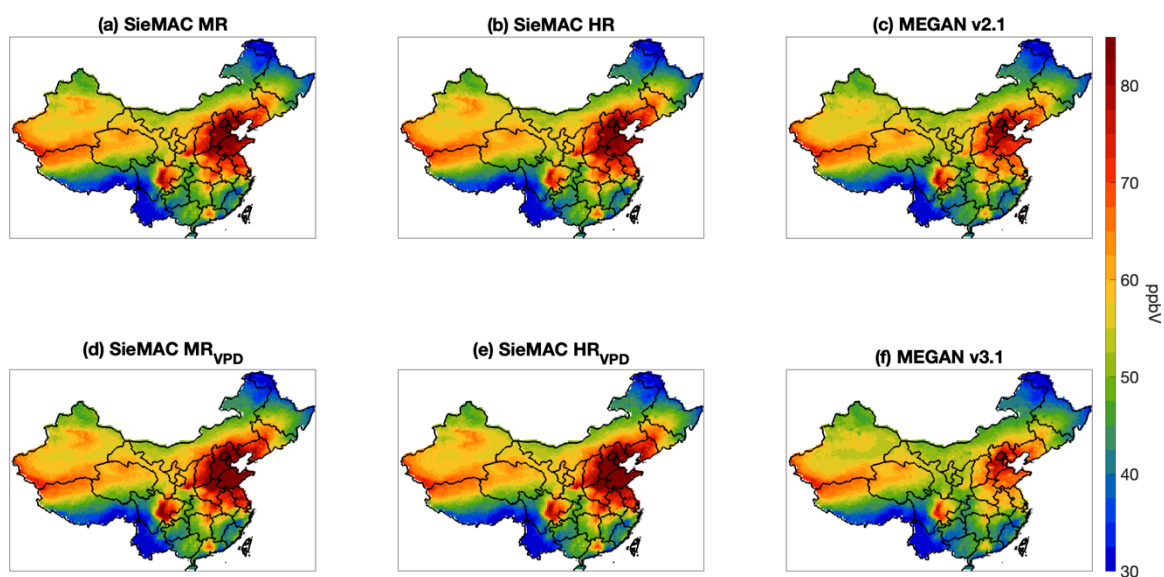


Figure S6. Seasonal mean daily maximum 8-h average ozone (MDA8) for June–August 2013 simulated with six emission inventories: (a) SieMAC MR, (b) SieMAC HR, (c) MEGAN v2.1, (d) SieMAC MR_{VPD}, (e) SieMAC HR_{VPD}, and (f) MEGAN v3.1. Colours indicate ozone concentration in ppbv (scale at right).

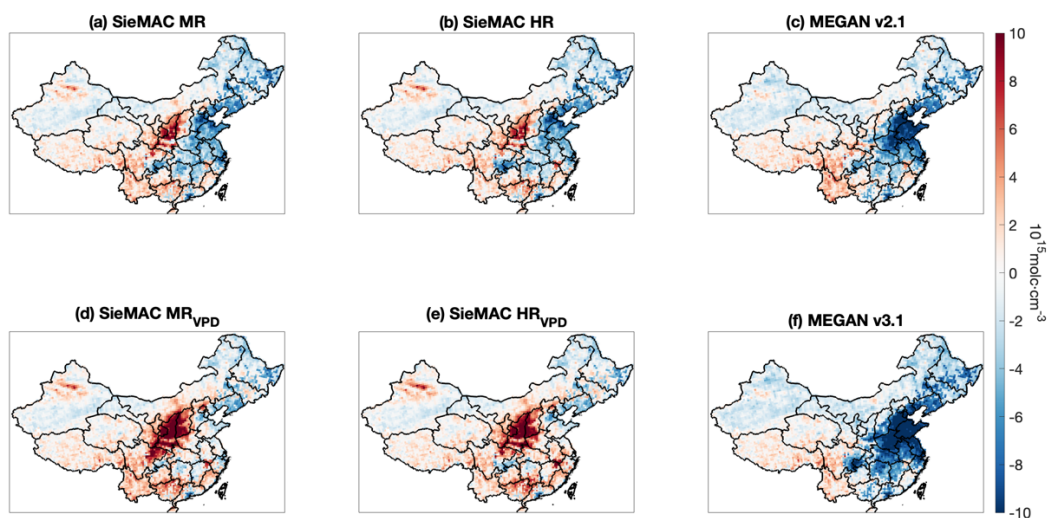


Figure S7. Spatial bias of summertime (June–August 2013) formaldehyde vertical columns in the model simulations relative to OMI satellite observations. Panels display model – OMI differences for (a) SieMAC MR, (b) SieMAC HR, (c) MEGAN v2.1, (d) SieMAC MR_{VPD}, (e) SieMAC HR_{VPD}, and (f) MEGAN v3.1. Colours indicate the bias in 10^{15} molec cm^{-2} (scale at right); warm shades denote model overestimates and cool shades model underestimates.

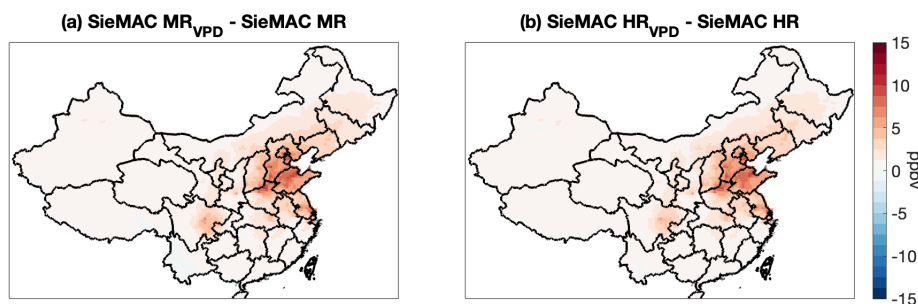


Figure S8. Effect of vapour-pressure-deficit (VPD) stress on summertime (June–August 2013) ozone. (a) shows the change in daily maximum 8-h average ozone (ΔMDA8) obtained by subtracting the unstressed run from the VPD-enabled run at medium resolution (SieMAC MR_{VPD} – SieMAC MR); (b) shows the same difference at high resolution (SieMAC HR_{VPD} – SieMAC HR). Colours denote the VPD-induced ozone change in ppbv (scale at right), with red shades indicating higher concentrations when VPD stress is included and blue shades indicating lower concentrations.

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